

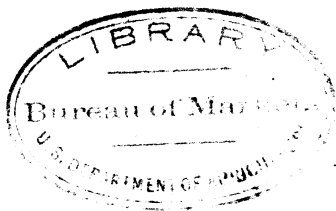
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# WHEAT GROWING IN THE SOUTHEASTERN STATES

CLYDE E. LEIGHTY

Agronomist in Charge of Eastern Wheat Investigations



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Contribution from the Bureau of Plant Industry

WM. A. TAYLOR, Chief

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**T**HE FARMERS in the six Southeastern States—Tennessee, North Carolina, Mississippi, Alabama, Georgia, and South Carolina—are encouraged to increase their wheat acreage on land suitable for the crop, as it leads to crop diversification and provides home-grown bread.

The sandy loam, silt loam, loam, and many of the clay soils when well drained and fertile are suited to wheat production. The lighter sandy soils, especially in the Coastal Plain, are better adapted for rye.

It is necessary to apply fertilizers to most of the southern soils, phosphorus being the principal element needed. Lime is also generally necessary for the best results.

Wheat should be grown only in rotation including legumes and cultivated crops.

Make the seed bed a fit place for the seed.

Fan and grade all seed before sowing, to remove trash and weed seeds, and treat with formaldehyde when the seed is infected with smut.

Soft red winter wheats are best, considered from all standpoints.

Home-grown seed should be used when it can be secured.

Late sowing is the most practicable and effective method of controlling the Hessian fly, but good farm practice is necessary for the best results when wheat is sown late.

Wheat will furnish much pasture for stock in the fall and winter.

# WHEAT GROWING IN THE SOUTHEASTERN STATES.

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## INCREASE IN THE WHEAT AREA.

THIS BULLETIN is written for wheat growers in the six Southeastern States—Tennessee, North Carolina, Mississippi, Alabama, Georgia, and South Carolina. No mention is made here of Florida, because wheat is not adapted to that State and is not successfully grown in it. The acreage of wheat has been increasing in these six States for several years past. Encouragement is given to this increase, as it leads to crop diversification and provides home-grown bread. Wheat can be grown on many of the heavier soils of these States. On the lighter, sandy soils, rye, also a bread grain, is better adapted.

In connection with the increase in the acreage of bread grains in this section attention must be given to the milling facilities. Local mills must be provided or it will be necessary to ship out the grain raised and ship in the flour.

## COST OF PRODUCTION AND YIELD PER ACRE.

The cost of production has increased considerably in recent years. On the other hand, the price of grain has increased greatly. The enhanced price of wheat will result in greater returns than recently from the crop. More attention to wheat production on the part of farmers in general may also result in making the wheat crop as valuable in certain sections of the South as in any part of the country.

The average yields per acre in bushels for the 10 years, 1907 to 1916, for these States have been as follows: Tennessee, 11.1; North Carolina, 10.5; Mississippi, 13.6; Alabama, 11.2; Georgia, 10.7; South Carolina, 10.4.

### SOILS ADAPTED TO WHEAT.

Wheat does best on well-drained loam, silt loam, and some of the clay soils. Light, sandy soils and heavy, poorly drained clay soils are not desirable for wheat. Since there is so much sandy land in the Coastal Plain, wheat is not a crop that can be generally grown there. On the heavier types of sandy loam soils in the Coastal Plain, however, good wheat yields can be obtained. Rye is a better crop than wheat on the light, sandy lands. The Piedmont and mountainous sections of the Southeastern States contain much good wheat land.

Wheat should not be sown on land the drainage of which is poor. If the land is subject to overflow or if water stands on it after rains, wheat should not be sown, for the plants will not live and thrive on such land. Low places in fields can often be drained sufficiently to prevent injury from standing water by opening furrows in the direction of the natural slope. An excessive amount of water in the soil is liable to result in winterkilling. A soil to be good for wheat should contain plenty of vegetable matter and plant food and should not be acid.

### FERTILIZERS.

For soils that are not in a good state of fertility for wheat the following application of fertilizer per acre, applied when the grain is sown, will be generally profitable:

Slaked lime or ground limestone, 1,000 to 4,000 pounds; applied two or three weeks before sowing.

Acid phosphate, 250 pounds; potash salts,<sup>1</sup> 25 to 50 pounds; nitrate of soda, 25 pounds; applied when the seed is sown.

Nitrate of soda, 50 to 75 pounds; applied after growth starts in the spring, generally early in March.

In place of these applications a 10-3-3 fertilizer, that is, one containing 10 per cent of phosphorus and 3 per cent each of nitrogen and potassium, may be used. Of this, 150 to 250 pounds per acre on the richer lands and 250 to 350 pounds on the poorer lands, may be applied when the wheat is sown. If some other formula of about the same composition is more readily obtainable it may be used. The principal requirement is a large amount of phosphorus and smaller amounts of the other elements. Under the present war conditions little, if any, potassium should be used.

Most of the southern soils are acid and are benefited by an application of lime either as slaked lime or ground limestone. Lime can be applied through the grain drill or lime spreader, preferably several weeks before the seed is sown. It may also be scattered over

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<sup>1</sup> It is not advisable to apply potash salts at present (1917) prices. This recommendation is made for normal conditions.

the plowed land with a shovel and harrowed in. There are some waxy limestone soils in central Alabama and northeastern Mississippi, and limestone valleys in several States, which, without lime are suitable for wheat if sufficient vegetable matter is incorporated in them. Nitrogen usually can be added most cheaply by growing legumes, such as velvet beans, cowpeas, soy beans, or the clovers. Phosphorus is generally deficient in southern soils and must be added as acid phosphate, steamed bone, etc., or in a complete fertilizer.

The best fertilizer to build up the land in preparation for wheat is 5 or 6 tons per acre of barnyard manure, to each ton of which 40 to 50 pounds of acid phosphate or rock phosphate (floats) is added before spreading. It is advisable to apply the manure to a preceding cultivated crop, such as potatoes or corn; otherwise, a heavy growth of straw and consequent lodging may result. If green manure, such as cowpeas or clover, is plowed under, 200 to 250 pounds of acid phosphate should be added per acre.

#### ROTATIONS.

Wheat should be grown only in rotation including legumes and cultivated crops. Local conditions should determine the rotation and the particular crop to be used. Wherever possible, wheat should follow some legume crop, such as cowpeas or soy beans, as better yields are obtained after these crops than after corn.

In the southern part of the cotton belt, where the boll weevil is a serious pest, the following rotation is giving good results:

*First year.*—Cotton. The cotton stalks plowed under early and wheat sown.

*Second year.*—Wheat, followed by cowpeas or soy beans to be cut for hay.

*Third year.*—Corn and velvet beans. Beans and cornstalks pastured and turned under in early spring for cotton.

Good farm practice under boll-weevil conditions requires that the cotton stalks be plowed under as soon as the bolls are all open and picked, care being taken to cover the stalks completely in order to destroy the insects. The land should then be gone over with a roller and the wheat sown with a disk drill. Harrowing is not advisable, as it unearths the buried stalks.

When velvet beans are grown with corn, which is the common practice in much of the southern half of the cotton belt, wheat can not be sown in the standing corn; neither can the crop be removed in time for fall seeding. It is necessary then that wheat follow some other crop than corn. Fortunately, better yields of wheat can be expected following cotton than after corn.

For the northern part of the cotton belt the rotation may be as follows:

(1) Cotton, with crimson clover sown at the last cultivation and plowed under the following spring.

(2) Corn, with cowpeas sown between the rows at the last cultivation.

(3) Wheat, followed by cowpeas, followed by rye, to be turned under in the spring. The cowpeas following the wheat crop may be cut for hay, or they may be disked in or plowed under as green manure.

In tobacco-growing sections wheat may follow tobacco in the rotation.

### PREPARATION OF THE SEED BED.

When wheat follows a cultivated crop that is removed sufficiently early, such as corn or tobacco, the soil can usually be prepared for seeding by the use of a disk and ordinary harrows. As soon as the crop is harvested the land should be gone over with the disk to prevent the growth of grass and weeds. A second disking, followed by harrowing, is given just before the grain is sown. A better seed bed can be prepared in this way than by plowing, and it takes much less time and work. If weeds are plentiful, plowing 3 or 4 inches deep may be necessary. Harrowing with an ordinary harrow should follow the plowing.

When wheat follows cotton the stalks should be plowed under as soon as the bolls are all open and picked. Plowing in this case should be deep enough to bury the stalks completely in order to destroy the boll weevil. The land should then be firmed with a roller and the wheat sown with a disk drill. Disking or harrowing is not advisable, as it unearths the buried stalks.

When wheat follows other than a cultivated crop, the seed bed should be prepared by plowing the land to a depth of 6 or 7 inches several weeks before seeding. It should then be harrowed at once and afterwards worked down with a harrow, disk, drag, or roller in such a manner as to kill all weeds that start to grow after rains and to settle the subsoil and keep the topsoil well broken up. When it is necessary to plow just before seeding, as when a catch crop of cowpeas is plowed under, the soil should be compacted by rolling and harrowing several times before seeding. In any case, when it is time to sow the grain, a fine, mellow seed bed should be prepared, using the harrow or other tools if necessary.

### PREPARING AND SOWING THE SEED.

#### PREPARATION OF THE SEED FOR SOWING.

Broken, immature, weevil-eaten, and shriveled grains, weed seeds, and all foreign material should be removed by fanning and grading the seed before it is sown. The fanning mill will also remove smut balls and many grains affected by scab, as these are lighter than the sound grain. On account of the many advantages from using clean seed the fanning mill should be used generally. There should be at least one in each community. If individuals find the cost too

high, several farmers may often find it desirable to own a mill in common.

Where stinking smut is present seed wheat should be treated with a solution of commercial formaldehyde in water. Detailed directions for such treatment are given on a later page.

Reliable seed dealers can generally furnish good wheat seed, or, better still, good seed can often be obtained of a local grower. Officers of the State agricultural experiment stations and county agents can usually refer growers to sources of good seed.

#### METHOD OF SOWING.

After a good seed bed is prepared, the properly fanned and treated seed should be sown about  $1\frac{1}{2}$  inches deep with a grain drill, if such an implement is available. The drill rows should be from 6 to 8 inches apart. The same drill that is used for seeding oats or barley can be used for wheat. A disk drill is preferable to the hoe or shoe drill where weeds and trash cover the land or where cotton stalks are plowed under. Such material is less likely to clog and be uncovered by the disk drill. On clean land, however, any kind of a drill may be used. By the use of a drill the seed is covered uniformly and placed in contact with moist soil, where it will germinate readily. Many experiments have shown that better results are obtained by sowing with a drill than by sowing broadcast.

When a drill is not available, however, wheat may be sown broadcast over the field from a 2-bushel bag slung over the shoulder and under one arm. The sown seed should then be covered by harrowing with an ordinary harrow. The use of broadcast seeders would lighten this labor, but such implements are almost unknown in the South. The man sowing the grain saves much labor and can sow more evenly and rapidly if he scatters the seed while standing or sitting in the rear end of a wagon being drawn slowly back and forth across the field. About one-fourth more seed should be sown broadcast than if drilled, as more seed is wasted.

#### TIME OF SOWING.

Wheat can be sown in the Southeastern States over a rather long period, extending from the latter part of September in the uplands of Tennessee and North Carolina to the latter part of November near the Gulf. The best time for seeding is about October 1 in the northern part and November 15 in the southern part. It will be necessary to delay seeding until about the average date of the first killing frost where the Hessian fly threatens. There is a further discussion of time of seeding in connection with the statements on the Hessian fly. (See p. 8.)



A good growth of the plant is necessary before cold weather begins, yet if the plant becomes jointed injury from freezing may result. If seeding is delayed until very late in the winter, sufficient winter growth is not secured and hot summer weather may injure or destroy the crop.

#### RATE OF SOWING.

The quantity of seed that should be sown under ordinary conditions is 6 pecks per acre. This may be varied according to the size of kernel of the variety used, the condition of the seed bed, the fertility and character of the soil, and the date of seeding. When a drill is used for sowing and the grains are small, the seed bed in good condition, the soil rich, warm, and well drained, and the seeding early, 5 or even 4 pecks per acre are often sufficient. When the seed is sown broadcast and opposite conditions exist, 7 or 8 pecks may give more profitable results. It is advisable to adhere to these rules with all varieties, regardless of any claims of exceptional tillering ability that may be made.

#### VARIETIES.

A variety that has been grown locally for several years and has become adapted to the locality is generally the best. The soft red winter wheats are best, considered from all standpoints, although the soft white winter wheats (not the Pacific coast white wheats) of the Northeastern States are well adapted. Beardless, smooth-chaffed varieties of red wheat, such as the Fultz, Purple Straw, Bluestem (not the Spring Bluestem), Georgia Red, Leap Prolific, Golden Chaff, and Currell, or bearded, smooth-chaffed varieties, such as Fulcaster, Dietz, and Red Wonder, may be grown with the greatest chance for success. The hard red winter wheats, such as Turkey and Kharkof, should not be sown in the South. The spring wheats of the upper Mississippi Valley may come through the winter, but are not well suited to this section. The durum wheats also are not suitable for this section.

#### PESTS OF THE WHEAT CROP.

##### INSECTS.

##### HESSIAN FLY.

The Hessian fly is a destructive pest of the wheat crop in some parts of the Piedmont and mountainous sections of the Southeastern States. It does not seem to have reached the Coastal Plain. Where this insect is present it is advisable to take precautionary measures to prevent injury by it.

The Hessian fly, being found in the "flaxseed" stage in wheat stubble and in unharvested wheat from June till September, or even

October in the South, can be destroyed or its damage prevented by carrying out the following methods of control:

(1) When the fly threatens do not sow wheat until after a fly-free date, which is approximately October 20 for the northern boundary of Tennessee and North Carolina, October 25 for the southern boundary of these States, and November 1 for all places having the approximate latitude of Atlanta.

(2) Burn, where possible and safe, all stubble and ruined wheat.

(3) Where burning is impracticable, disk or plow all stubble and ruined wheat immediately after harvest and put in a legume crop, such as cowpeas or soy beans.

(4) Plow under deeply all stubble and ruined wheat fields before August 15, harrow the ground, and roll if necessary.

(5) Harrow, disk, pasture, or otherwise effectually destroy all volunteer wheat.

(6) As a measure preparatory to sowing, plow as early and deeply as existing conditions will permit; disk, harrow, and roll until a thoroughly pulverized, compact seed bed is obtained.

Where stubble fields can not be burned over or cultivated because of seedings of clover or grass, the only practicable method that the farmer can use is that of delaying his wheat sowing until the flies have made their way from the stubble to the fields and died there without being able to find any plants upon which to deposit their eggs.

*Best cultural methods advocated in combating Hessian fly.*—The most serious objection to the most practicable and effective method that can be employed to control this pest in the field—namely, late sowing—is that there is danger of so delaying the growth of the plants that they do not become sufficiently advanced to enable them to withstand the winter. The ill effects of late sowing can be largely avoided by good farming practices. The most practicable and effective methods of controlling the Hessian fly are identical with the best methods of producing the maximum yields of wheat. It is perfectly possible for the farmer to fight the Hessian fly by the process of good farming, involving thorough cultivation, good seed, and a rotation of crops, and by the application of fertilizer containing readily available plant food along with the grain at the time of sowing.

#### INSECTS INJURIOUS TO STORED GRAIN.

The most serious damage to wheat in shock, stack, or bin is done by the angoumois grain moth and the black weevil.<sup>1</sup> These insects may be destroyed in grain stored in bins or barrels by the use of liquid carbon disulphid.

Place the grain in air-tight bins holding from 30 to 40 bushels. Place 1 pound of carbon disulphid in a shallow vessel on top of the grain and cover the top of the bin as tightly as possible. The liquid

<sup>1</sup> Detailed information concerning these pests and complete directions for destroying them are contained in Farmers' Bulletin 799.

readily vaporizes, and the fumes, being heavier than air, pass down through the grain, destroying all insects. This method is most effective when the temperature is about 75° F.

#### DISEASES.

##### SMUTS.

The smuts are common diseases of wheat in the Southeastern States. There are two of them, the stinking smut, or bunt, and the loose smut. They can be distinguished easily, since the stinking smut has a distinct, disagreeable odor which can be recognized in the thrashed grain, while the loose smut does not have such an odor. The stinking smut when present forms smut balls, consisting of a compact mass of dark-brown spores within a thin, gray membrane. When these smut balls are crushed, only a dark-colored, dustlike material remains. In heads affected by loose smut the kernels are entirely destroyed, and there is left in the field just before harvest only the rachis or central stem of the head.

*Treating the seed for smut.*—The loose smut can not be controlled by formaldehyde treatment but can be controlled by hot-water treatment. The hot-water treatment, however, is difficult to apply and is not generally practicable for farmers to use. The stinking smut, or bunt, can be controlled and even eliminated by treating the seed with formaldehyde. The formaldehyde treatment is easy to apply. Formaldehyde can be purchased at any drug store at a cost of about 50 cents a pound. The proper strength of the solution for treating seed wheat is 1 pound of 40 per cent commercial formaldehyde to 40 gallons of water. The following method is effective for controlling smut:

After running seed wheat through a fanning mill to remove the smut balls, spread it on a clean floor or on a tarpaulin and sprinkle the formaldehyde solution over the grain, using about 1 gallon to each bushel. The grain should be stirred thoroughly while being sprinkled, and the process should be continued until every kernel is wet. Then cover the grain with a canvas or some other heavy material and allow it to lie from one to five hours. It should then be uncovered and stirred occasionally until dry. It is then ready for seeding.

In treating grain care should be taken to have the solution the right strength. If too weak it will not kill the spores. If too strong it will injure the grain. Be sure the formaldehyde you buy is full strength. Wash out the drill with the formaldehyde solution. This will destroy any smut spores that may be in the drill.

Other effective methods of controlling stinking smut are as follows:

- (1) Prepare the formaldehyde solution in barrels. Put the grain to be treated in burlap sacks. Fill the sacks not more than half full and immerse them in the solution for 10 minutes; then hang them up to drain and dry. The sacks should be shaken occasionally to hurry the drying process.

(2) When all smut balls are not removed by the fanning process it is advisable to immerse the seed in a formaldehyde solution. There are several methods of doing this, one of the most convenient of which is as follows: A hole is bored at the bottom of each of two tubs or half barrels with handles. This hole is fitted with a plug and covered with a wire screen on the inside of the tub, so that grain can not pass through. One tub is set above the other. The upper tub is then filled two-thirds full with the formaldehyde solution and the seed poured in. As the seed is poured in and stirred, smut balls, chaff, and light kernels rise to the surface and are skimmed off. When the skimming is completed the plug is removed and the formaldehyde solution is allowed to drain into the tub beneath. The grain is then removed and spread out to dry. The empty tub is placed on the ground, the other tub on the stand, and the process is continued, more of the solution being added when necessary.

A convenient modification of this method is to provide two tubs, a large one and a smaller one, the latter made of substantial wire mesh or of iron or tin with a perforated plate or wire bottom. The larger tub is two-thirds filled with the formaldehyde, the other tub is set down in it, and the grain poured in and stirred. The smut balls and foreign material will again rise to the surface and can be skimmed off. When this is done the smaller tub containing the grain can be removed from the solution, which is allowed to drain off, and the grain is emptied on the floor and dried.<sup>1</sup>

#### RUST.

The disease most injurious to wheat and the factor that usually limits yields the most in the Southeastern States is rust. This affects both stems and leaves, reddish and black spots forming on these parts. Its development is favored by dampness and heat. It is most destructive on low, damp land. Early-ripening varieties will generally be less affected than late varieties. There are no rust-proof varieties for the South, but some are more resistant than others. Sowing on fertile, well-drained uplands and the use of early varieties are the most successful methods of combating the disease. Seed treatments are not effective in preventing rust.

#### WEEDS.

##### CHEAT, OR CHESS.

Cheat, or chess, is often found in wheat fields and in the thrashed grain. When present it lowers the quality of wheat for milling purposes. Cheat is not as easily winterkilled as wheat and will endure more unfavorable conditions. This has caused many people to believe that wheat turns to cheat. This is not true, for cheat grows only from cheat seed, usually sown with the wheat. The fanning mill will remove most of these seeds.

##### WILD ONION, OR GARLIC.

Wild onion, or garlic, is the worst weed pest in many southern wheat fields. It is very difficult to remove from the thrashed

<sup>1</sup> For a more complete discussion of the smuts of grain and of smut treatments, see Farmers' Bulletin 507.

grain and to eradicate from farms. Wheat containing onions is usually docked heavily. Bread made from garlicky flour, especially if eaten warm, has a pronounced odor and flavor. Avoid sowing wheat containing onion bulblets and use every means to rid the farm of wild onions if they are already established.<sup>1</sup>

#### COCKLE.

Cockle has black, rough seeds which have about the same diameter as wheat kernels. They can not be removed easily and are very injurious to flour. Special care should be taken to sow only seed free from cockle and to remove all plants that appear in wheat fields.

#### PEPPERGRASS.

Peppergrass is another weed of southern wheat fields that should be guarded against. The seeds of this plant should be removed from the seed wheat before sowing by thorough fanning and grading.

### USES OF THE WHEAT CROP.

#### WHEAT AS A NURSE AND COVER CROP.

Winter wheat as a nurse crop for clover and grass seedings is inferior to winter barley, but superior to winter oats. Winter barley matures earlier than wheat and does not grow so tall. Winter oats make too dense a growth, while spring oats, in addition to their dense growth, occupy the land a longer time. When used as a nurse crop the stubble should be left high, to furnish protection and support to the young grass and clover plants. The shocked grain should be removed as early as possible after cutting, to avoid injury to the seeding. A good stand of wheat is also a valuable cover crop, preventing the washing of the soil and the leaching out and loss of plant food and fertilizers.

#### PASTURING AND MOWING.

It frequently happens in the Southern States that an overabundance of foliage is produced in the fall and danger of winter injury is increased thereby. It is often advisable under these conditions to mow off the plants in the fall or pasture moderately. As growing wheat is an excellent feed, it is more profitable to dispose of the excess growth in the late fall or early spring by pasturing. However, excessive pasturing at any time, pasturing when the soil is wet, and late spring pasturing are very injurious and should be entirely avoided. Lodging can be reduced by judicious mowing or pasturing.

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<sup>1</sup>Methods of eradicating wild onions are given in Farmers' Bulletin 610.

### WHEAT AS A PASTURE AND HAY CROP.

Wheat is a better crop for pasture on the heavier clay soils than rye, but rye is much better on the sandy soils. Wheat can be pastured more closely without apparent injury than oats or barley. If wheat is to be cut for grain, however, it should not be pastured late in the spring. Wheat is an excellent hay crop, but is inferior to oats. It is superior to rye for this purpose.

### HARVESTING THE CROP.

#### TIME OF CUTTING.

Wheat may be cut with safety when the straw has lost nearly all its green color and the grains are not entirely hardened. If cut sooner than this, shriveled kernels will result. If left standing until fully ripe, a bleached appearance, due to the action of the elements, often results, and loss from shattering may ensue. Wheat that is fully ripe is also more difficult to handle. Where the area of wheat is large, cutting should begin as early as it can be done safely.

#### MANNER OF CUTTING.

The self-binder is the best implement to use for cutting wheat in the Southeastern States. The old method of cutting with a cradle can be used on very rough land and for small patches where wheat is not an important farm crop. For very small patches a hand sickle may be used.

#### SHOCKING.

Wheat should be shocked in the field immediately after being cut and bound. A shock is begun by standing two bundles in a nearly upright position with heads together and butts sufficiently apart to prevent falling over. From 8 to 12, and sometimes more, bundles are then set up about these until a round shock of the proper size is formed. The number of bundles to place in a shock depends upon the degree of ripeness, the length of straw, and the size of the bundle, fewer bundles being used where the straw is short or not fully ripe. In placing the bundles the butts should be jammed into the stubble to insure firmness and the heads should lean inward sufficiently to prevent falling over. When this part of the shock is completed it should be covered as perfectly as possible with two bundles, the heads of which have been broken down at the band, to form a cap. This cap should be placed so as to protect the standing bundles from rain and sun as much as possible. If the heads of the cap are placed on the side of the shock toward the prevailing winds, some protection against blowing off may be afforded.

**STACKING AND STORING.**

Thrashing directly from the shock is the most common practice in this section. It is often advisable to protect wheat by stacking or storing it in the barn as soon as it is dried out in the shock. The cost of thrashing from the shock is generally somewhat less than the cost of stacking or storing in the barn and thrashing from the stack or barn. Better protection is afforded the grain by stacking or storing, which is very important when thrashing can not be done soon after cutting. A sweating process also takes place in the stack and barn, which improves to some extent the color, condition, and test weight of the grain and its milling and baking qualities. The additional cost, if any, resulting from stacking wheat is often offset by the better price received on account of the better quality. It is also possible in wet weather to thrash out the wheat more completely from the straw and to remove more of the chaff when stacking and storing are practiced.

**THRASHING.**

Thrashing should not be attempted when wheat or straw is wet or tough, as good results can not then be obtained. Wheat can dry out much better in the head than after being thrashed. If thrashed wet and marketed immediately it is discounted heavily in price; if placed in a bin it is likely to become hot and badly damaged.

The wheat straw may be stacked in the open, stored in the mow, or spread at once over the field. When the price is good it may be sold. It should never be burned. Straw furnishes excellent roughage for live stock, while by using it for bedding in stalls a large part of the valuable liquid manure can be preserved. Rotted straw from an old straw pile or from straw spread directly on the field makes good manure, as each thousand pounds of straw contains on the average about 8 pounds of potassium, 5 pounds of nitrogen, and smaller amounts of other important plant foods. A thousand pounds of wheat grain removes on the average about 20 pounds of nitrogen and about  $3\frac{1}{2}$  pounds each of potassium and phosphorus.